

REMARKS

The present application includes claims 1-20. Claims 1-20 were rejected by the Examiner.

Claims 1-7, 9, 10, 12-16, 19, and 20 were rejected under 35 U.S.C. 102(b) as being anticipated by Oikawa (U.S. Patent No. 6,411,674).

Oikawa relates to a radiation tomography device configured for Laminography, a radiographic technique in which images of tissue above and below a plane of interest are blurred out by movement of the x-ray tube and the detector film holder in order to show a specific area more clearly. See, e.g., Abstract. Thus, a Laminographic angle α_2 is adjusted in Oikawa, not to create a virtual isocenter and maintain an object being imaged at that virtual isocenter but isolate a particular area of the object for imaging. See, e.g., Figure 4 of Oikawa and col. 2, lines 37-42 and 54-56.

Additionally, as Oikawa varies a ratio between a distance from the x-ray tube to the subject and a distance from the subject to the detector sheet, magnification of the transmitted image changes. Col. 8, lines 43-64. However, Oikawa fails to teach or suggest normalizing the change in magnification. Such normalization is recited in the claims of the present application. As described in the application, one benefit of normalizing the change in magnification is to compensate for distortion and irregularity in images due to the non-isocentric motion. Oikawa fails to provide motivation for such a technique as well as failing to disclose the non-isocentric motion in the first place. Oikawa does not form and maintain a virtual isocenter.

In current C-arm x-ray fluoroscopy imaging systems, a 3D tomographic image reconstruction may be performed by sweeping the C-arm in a semi-circular arc around an object

of interest. Using cross-arm motion, the arc is circular and therefore isocentric. For example, using a C-arm, an x-ray beam may be swept around a head of a patient (e.g., a CT scan in a circular arc around the head). The volume image reconstruction is performed through 2D projection scan images. Sweeps are accomplished on cross-arm motion with the C-arm positioned at the head of a table sweeping around the head of the table. Thus, the object stays at the center (isocentric motion).

However, a view from a side of the patient or other object being imaged may result in motion occurring along a non-isocentric path. Performance of 3D tomographic reconstruction with an orbital motion of the C-arm is restricted because the paths of the x-ray source and detector are not isocentric. The object does not remain at the isocenter of the system. Resulting projection images are distorted due to the non-isocentric imaging arc and are unusable for clinical, diagnostic, or navigational purposes. The magnification change is quantified for the relationship between the volume of interest and the projection image(s). The magnification change data is used to adjust or normalize the image data to reconstruct the desired image(s) of the object. Thus, the pending claims provide a system and method facilitating 3D image reconstruction using a non-isocentric imaging arc and compensation for distortion and irregularity of the projection images due to non-isocentric motion.

For at least these reasons, the Applicant respectfully submits that independent claims 1, 9, and 15 should be allowable over the cited art of record. Since claims 2-8, 10-14, and 16-20 depend from allowable claims 1, 9, and 15, respectively, the Applicant submits that claims 2-8, 10-14, and 16-20 should also be allowable over the cited art of record.

More specifically, with regard to dependent claims 2 and 10, Oikawa discusses varying a distance between the detector and an object but provides no mention of any sort of tracking or

tracking system for detector and object position, as recited in claims 2 and 10. See, e.g., col. 3, lines 19-20.

With regard to claim 3, Oikawa mentions varying the Laminographic angle between axes but not the distance between the object and detector and/or source between obtaining image exposures. See, e.g., col. 2, lines 40 and 55-56.

With regard to claims 4 and 12, Oikawa discloses a ratio of the distance between the detector and the object and the distance between the source and the object, but not a distance between the detector and the source. See, e.g., col. 8, lines 50-51.

With regard to claims 7 and 14, Oikawa fails to disclose moving the C-arm in a non-circular path while varying the distance between the detector and the object. See, e.g., col. 8, lines 43-64.

Claim 8 was rejected under 35 U.S.C. 103(a) as unpatentable over Oikawa in view of Endo et al. (U.S. Patent No. 5,452,337). As discussed above, Oikawa fails to teach or reasonably suggest all the limitations of claim 1, from which claim 8 depends. Additionally, as noted by the Examiner, Oikawa fails to teach reconstruction a three-dimensional image of an object based on image data and a normalized magnification change. The Examiner relies on Endo for those limitations. However, the magnification change of Endo is not *normalized* and may *change*. See, e.g., col. 10, lines 6-33. Furthermore, the Applicant submits that a general desire to improve imaging analysis represents insufficient motivation to combine. The portion cited by the Examiner (coal. 1, lines 5-10) simply states that the invention of Endo relates to a radiation diagnostic system capable of providing a three-dimensional pictorial image.

For at least these reasons, the Applicant respectfully submits that claim 8 should be allowable over the cited art of record.

Claims 11, 17, and 18 were rejected under 35 U.S.C. 103(a) as being unpatentable over Oikawa in view of Habraken et al. (U.S. Patent App. Pub. No. 2001/0031039). As discussed above, Oikawa fails to teach or reasonably suggest all the limitations of claims 9 and 15, from which claims 11 and 17-18 depend, respectively. Additionally, as noted by the Examiner, Oikawa fails to teach a method wherein a tracking system comprises an electromagnetic tracking system for determining a position of a detector with respect to an object. In fact, Oikawa fails to disclose any tracking system. The Examiner points to Habraken for those limitations. However, Habraken simply provides an electromagnetic object sensor in order to prevent collisions between movable parts and, for example, a patient to be examined. See, e.g., Abstract. A tracking system is not recited in the pending claims to simply prevent collisions between movable parts but rather to aid in determining and monitoring detector and object position for establishing a virtual isocenter and adjusting obtained image data based on a change in magnification due to varying the distance between the object and the detector and/or source. A magnification change may be quantified and compensated for during tomographic image reconstruction using detector position and detector-to-object distance identified using the tracking system.

For at least these reasons, the Applicant respectfully submits that claims 11, 17, and 18 should be allowable over the cited art of record.

The Applicant submits that the pending claims are allowable over the art cited by the Examiner but not relied upon in his rejections (Testic, U.S. Patent No. 5,287,436, and Navab, U.S. Patent No. 6,236,704).

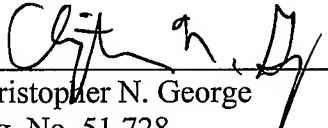
CONCLUSION

The Applicants submit that the present application is in condition for allowance. If the Examiner has any questions or the Applicants can be of any assistance, the Examiner is invited and encouraged to contact the Applicants at the number below.

The Commissioner is authorized to charge any additional fees or credit overpayment to the Deposit Account of GTC, Account No. 070845.

Respectfully submitted,

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